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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/687,186	10/16/2003	Sergey D. Lopatin	039153-0484 (G1190)	7567

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EXAMINER	
NGUYEN, THANH T	
ART UNIT	**PAPER NUMBER**
2813	

DATE MAILED: 12/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/687,186	LOPATIN ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *10-14* is/are allowed.

6)☒ Claim(s) *1-6 and 15-19* is/are rejected.

7)☒ Claim(s) *5,7-9 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Oath/Declaration

Oath/Declaration filed on 10/16/03 has been considered.

Claim Objections

Claim 5 is objected to because of the following informalities: The limitation "indium (Sn)" in line 2 of claim 5 should be changed to "indium (In)". Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 4, 6, 15-17, 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Huang (U.S. Patent No. 6,706,626).

Regarding to claim 1 . A method of using an adhesion precursor in an integrated circuit fabrication process, the method comprising:

providing a gas of material (see col. 5, lines 5-16) over a dielectric material to form an adhesion precursor Layer (112), the dielectric material (104) including an aperture (opening, 108); and

providing a copper Layer (250, see col. 8, lines 51-53) over the adhesion precursor Layer (112).

Regarding to claim 2. the adhesion precursor Layer includes a barrier material (TiN/TaN, see col. 5, lines 6-16).

Regarding to claim 4, providing a second gas of a second material over the adhesion precursor Layer (see col. 5, lines 38-45).

Regarding to claim 6. providing a third gas of a third material over a Layer formed by the second gas (see col. 7, lines 10-40, wherein multi-layered metal nitride barrier layer 214 by using MOCVD process, since there are multi-layered barrier formed, it will require multiple gas).

Regarding to claim 15. A method of using an adhesion precursor for chemical vapor deposition, the method comprising:

forming a trench (108) in a dielectric layer (104);

forming a continuous barrier layer (112, see figure 4) above the dielectric layer and along sides of the trench;

depositing copper (122, see figure 8, col. 8, lines 50-54) above the continuous barrier layer, the copper located in the trench forming an integrated circuit feature (see figure 8).

Regarding to claim 16, the continuous barrier layer (112) is formed from a gas having a ternary element (TDMAR or TDEAT, has more than 3 elements, example C/H/Ti/N).

Regarding to claim 17, providing a chemical mechanical polish to level the copper to substantially the same level as the continuous barrier layer above the dielectric layer (see figure 9, col. 5, lines 65-67).

Regarding to claim 19, wherein the feature is a via (108, opening, see figure 2).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3, 11, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (U.S. Patent No. 6,706,626) as applied to claims 1-2, 4, 6, 15-17.

Huang teaches a method of forming an adhesion precursor for CVD deposition. However, the reference does not teach the thickness of the barrier.

The specific thickness range of claim 3, 11, 14, 18 are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In

re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

> "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."
> *In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmscher 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*
> Therefore, one of ordinary skill in the requisite art at the time the invention was made

would have used any thickness range suitable to the method in process of Huang in order to optimize the process.

Allowable Subject Matter

Claims 10-14 are allowed over the prior art.

Claims 5, 7-9, 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

None of the prior art alone or in combination teaches a method of forming an adhesion precursor gas, wherein the second gas includes tin (Sn), indium (Sn), zinc (Zn), or chromium (Cr), the third gas includes an alloying element, the continuous barrier layer is formed from a gas having a ternary element of material selected from a group consisting of iridium (Ir), Ruthenium (Ru), and Rhenium (Re), a gas including an alloying agent over the adhesion precursor Layer, providing an alloy layer above the adhesion precursor Layer.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN